

CLAIMS

1. A pulsed laser diode driver comprising:

a slow voltage discharge stage comprising a first energy storage element having a first energy storage capacity at a first voltage magnitude;

a fast voltage discharge stage comprising a second energy storage element having a second energy storage capacity at a second voltage magnitude, the second energy storage capacity being less than the first energy storage capacity, and the second voltage magnitude being greater than the first voltage magnitude;

a switch-controlled circuit path; and

a laser diode controllably coupled to the first energy storage element and to the second energy storage element through the switch-controlled circuit path.

2. The pulsed laser diode driver of claim 1 further comprising a first charge source for establishing the first magnitude voltage, and a second charge source for establishing the second magnitude voltage, wherein:

the first energy storage element is a first capacitor coupled to the first charge source;

the second energy storage element is a second capacitor coupled to the second charge source;

the switch-controlled circuit path comprises a switch having a first terminal coupled to a first terminal of the laser diode, and a second terminal coupled to a first terminal of the first capacitor and to a first terminal of the second capacitor; and

a second terminal of the laser diode is coupled to a second terminal of the first capacitor and to a second terminal of the second capacitor.

3. The pulsed laser diode driver of claim 2 wherein the first terminal of the switch is grounded.

4. The pulsed laser diode driver of claim 2 wherein:

the first terminal of the switch is not grounded; and

the second terminal of the switch is not grounded.

5. The pulsed laser diode driver of claim 1 further comprising a first charge source for establishing the first magnitude voltage, and a second charge source for establishing the second magnitude voltage, wherein:

the first energy storage element is a first capacitor coupled to the first charge source;

the second energy storage element is a second capacitor coupled to the second charge source;

the switch-controlled circuit path comprises a first switch and a second switch, the first switch having a first terminal coupled to a first terminal of the laser diode and a second terminal coupled to a first terminal of the first capacitor, and the second switch having a first terminal coupled to the first terminal of the laser diode and a second terminal coupled to a first terminal of the second capacitor; and

a second terminal of the laser diode is coupled to a second terminal of the first capacitor and to a second terminal of the second capacitor.

6. The pulsed laser diode driver of claim 5 wherein:

the first terminal of the first switch is grounded; and

the first terminal of the second switch is grounded.

7. The pulsed laser diode driver of claim 2 wherein:

the first terminal of the first switch is not grounded;

the second terminal of the first switch is not grounded;

the first terminal of the second switch is not grounded; and

the second terminal of the second switch is not grounded.

8. The pulsed laser diode driver of claim 1 wherein the switch-controlled circuit path comprises a first switch having a floating terminal and a second switch having a grounded terminal, the floating terminal of the first switch being coupled to a first terminal of the laser diode, and the grounded terminal of the second switch being coupled to a second terminal of the laser diode.

9. The pulsed laser diode driver of claim 1 wherein the switch-controlled circuit path comprises at least one switch that comprises a single switch device, a series circuit of individual switch devices, a parallel circuit of individual switch devices, or any combination of the foregoing.

10. The pulsed laser diode driver of claim 1 wherein the first energy storage element comprises a capacitor, a pulse forming network, a battery, a fuel cell, an array of one or more of the foregoing, or any combination of the foregoing.

11. The pulsed laser diode driver of claim 1 wherein the second energy storage element comprises a capacitor, a pulse forming network, a battery, a fuel cell, an array of one or more of the foregoing, or any combination of the foregoing.

12. The pulsed laser diode driver of claim 1 wherein the laser diode comprises a single laser diode device, an array of laser diode devices connected in series, an array of laser diode devices connected in parallel, or any series or parallel connection of the of the foregoing.

13. The pulsed laser diode driver of claim 1, further comprising:

an additional fast voltage discharge stage comprising a third energy storage element having a third energy storage capacity at a third voltage magnitude, the third energy storage capacity being less than the second energy storage capacity, and the third voltage magnitude being greater than the second voltage magnitude;

the laser diode being controllably coupled to the third energy storage element as well as to the first energy storage element and to the second energy storage element through the switch-controlled circuit path.

14. A method for driving a laser diode with a current pulse, comprising:

establishing a first voltage magnitude in a first energy storage element having a first energy storage capacity;

establishing a second voltage magnitude in a second energy storage element having a second energy storage capacity, the second energy storage capacity being smaller than the first energy storage capacity, and the second voltage magnitude being greater than the first voltage magnitude; and

discharging the first energy storage element and the second energy storage element into a laser diode, the discharge of the first energy storage element essentially furnishing a flattop current pulse to the laser diode, and the discharge of the second energy storage element essentially establishing a risetime characteristic of the current pulse.

15. The method of claim 14 wherein:

the first energy storage element is a first capacitor and the first energy storage capacity is a first capacitance, the first capacitor being coupled to a first charge source;

the second energy storage element is a second capacitor and the second energy storage capacity is a second capacitance smaller than the first capacitance, the second capacitor being coupled to a second charge source; and

during the discharging step, the discharge of the second capacitor depletes the charge on the second capacitor before a very high current pulse is established through the laser diode.

16. The method of claim 15 wherein the current pulse comprises no appreciable overshoot attributable to the discharge of the second capacitor.

17. The method of claim 15 wherein the current pulse comprises appreciable overshoot attributable to the discharge of the second capacitor.

18. The method of claim 14 further comprising:

establishing a third voltage magnitude in a third energy storage element having a third energy storage capacity, the third energy storage capacity being smaller than the second energy storage capacity, and the third voltage magnitude being greater than the second voltage magnitude; and

discharging the third energy storage element into the laser diode, the discharge of the third energy storage element essentially establishing the risetime characteristic of the current pulse along with the discharge of the second energy storage element.

19. A pulsed laser diode driver comprising:

means for establishing a first voltage magnitude in a first energy storage element having a first energy storage capacity;

means for establishing a second voltage magnitude in a second energy storage element having a second energy storage capacity, the second energy storage capacity being smaller than the first energy storage capacity, and the second voltage magnitude being greater than the first voltage magnitude; and

means for discharging the first energy storage element and the second energy storage element into a laser diode, the discharge of the first energy storage element essentially furnishing a flattop current pulse to the laser diode, and the discharge of the second energy storage element essentially establishing a risetime characteristic of the current pulse.

20. The pulsed laser diode driver of claim 19 further comprising:

means for establishing a third voltage magnitude in a third energy storage element having a third energy storage capacity, the third energy storage capacity being smaller than the second energy storage capacity, and the third voltage magnitude being greater than the second voltage magnitude; and

means for discharging the third energy storage element into the laser diode, the discharge of the third energy storage element essentially establishing the risetime characteristic of the current pulse along with the discharge of the second energy storage element.